



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2017-0135; Special Conditions No. 25-646-SC]

Special Conditions: Embraer S.A., Model ERJ 190-300 Series Airplanes; Flight Envelope Protection: Pitch, Roll, and High-Speed Limiting Functions

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Embraer S.A. Model ERJ 190-300 series airplanes. These airplanes will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. This design feature is an electronic flight control system that contains fly-by-wire control laws, including flight envelope protection functions that impose pitch-angle, bank-angle, and high-speed limits during normal operation. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: This action is effective on Embraer S.A. on **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. We must receive your comments by **[INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Send comments identified by docket number FAA-2017-0135 using any of the following methods:

- ☐ *sFederal eRegulations Portal:* Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.
- ☐ *aMail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- ☐ *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- ☐ *oFax:* Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket Web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov/>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Joe Jacobsen, FAA, Airplane and Flight Crew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification

Service, 1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-2011; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION: The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions is impracticable because these procedures would delay issuance of the design approval and thus delivery of the affected airplane.

In addition, the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon publication in the Federal Register.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On September 13, 2013, Embraer S.A. applied for an amendment to Type Certificate (TC) No. A57NM to include the new Model ERJ 190-300 series airplanes. The ERJ 190-300 is a twin-engine, transport-category airplane derivative of the ERJ 190-100 STD. The ERJ 190-300 series airplane will have a maximum occupancy of 114 passengers and will include a new wing design with a high aspect ratio and raked wingtip, and a digital fly-by-wire electronic flight control system.

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.101, Embraer S.A. must show that the ERJ 190-300 meets the applicable provisions of the regulations listed in Type Certificate No. A57NM or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA. Embraer S.A. must show that the ERJ 190-300 meets the applicable provisions of 14 CFR part 25, as amended by Amendments 25-1 through 25-137.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the ERJ 190-300 because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design features, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the ERJ 190-300 must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

The ERJ 190-300 will incorporate the following novel or unusual design feature:

An electronic flight control system that contains fly-by-wire control laws, including flight envelope protection functions that impose pitch-angle, bank-angle, and high-speed limits during normal operation.

Discussion

The Embraer S.A. ERJ 190-300 design has a full-digital flight control system, referred to as fly-by-wire architecture. The fly-by-wire architecture provides closed-loop flight control laws and multiple protection functions.

The basic characteristics of pitch, bank, and high-speed limiting functions are as follows:

1. Pitch Limiting Function:

While in normal mode, the ERJ 190-300 airplane presents positive and negative pitch attitude soft limits. After surpassing the established limits set at 30° and -15° , the airplane presents a natural tendency to return (positive stability) to within these limits when pitch control is released.

2. Bank Limiting Function (Spiral Stability and Roll Limiting):

While in normal mode at speeds up to V_{MO}/M_{MO} (maximum operating limit speed), the ERJ 190-300 airplane presents neutral stability up to 33° bank angle. Above 33° , positive spiral stability is introduced; however, there is no bank angle hard limit. When overspeed protection is engaged, positive spiral stability is provided in the range of $\pm 33^\circ$ and a bank angle hard limit (non-overridable) is set at that bank angle.

3. High-Speed Limiting Function (Overspeed Protection):

While in normal mode, the overspeed protection function prevents pilots from exceeding the airplane maximum design speeds by providing strong positive stability at and above V_{MO}/M_{MO} , and limiting aircraft speed to V_{DF}/M_{DF} (demonstrated flight diving speed).

The controllability and maneuverability requirements of 14 CFR 25.143 do not specifically relate to flight characteristics associated with fixed attitude limits or a high-speed limiter that might preclude or modify flying qualities assessment in the overspeed region.

These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these special conditions are applicable to the ERJ 190-300 series airplanes. Should Embraer S.A. apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, these special conditions would apply to that model as well.

Conclusion

This action affects only a certain novel or unusual design feature on one model of airplane. It is not a rule of general applicability.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, because a delay would affect the certification of the airplane, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions upon publication in the Federal Register. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Embraer S.A. Model ERJ 190-300 series airplanes.

Flight Envelope Protection: Pitch, Roll, and High-Speed Limiting Functions.

In addition to § 25.143, the following requirements apply:

1. Pitch and Roll Limiting Functions.

a. The pitch limiting function must not impede normal maneuvering for pitch angles up to the maximum required for normal maneuvering, including a normal all-engines operating takeoff, plus a suitable margin to allow for satisfactory speed control.

b. The pitch and roll limiting functions must not restrict or prevent attaining pitch attitudes necessary for emergency maneuvering or roll angles up to 66° with flaps up or 60° with flaps down. Spiral stability, which is introduced above 33° roll angle, must not require excessive pilot strength to achieve these roll angles. Other protections, which further limit the roll capability under certain extreme angle of attack or attitude or high speed conditions, are acceptable, as long as they allow at least 45° of roll capability.

c. A lower limit of roll is acceptable, beyond the overspeed warning, if it is possible to recover the aircraft to the normal flight envelope without undue difficulty or delay.

2. High-Speed Limiting Functions.

Operation of the high-speed limiter during all routine and descent procedure flight must not impede normal attainment of speeds up to overspeed warning.

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